

**WHAT IS CLAIMED IS:**

1           1.     A method for communicating in a wireless multi-hop system having at  
2     least one base station, at least one relay station, and user equipment, the method  
3     comprising:

4                 communicating between a relay station and a base station using a first  
5     radio interface;

6                 communicating between user equipment and the relay station using a  
7     second radio interface; and

8                 processing the communication between the relay station and the base  
9     station with the first radio interface separately from the communication between  
10    user equipment and the relay station.

1           2.     The method claim 1, further comprising multiplexing communication  
2     between the relay station and the base station and between the relay station and  
3     at least one other relay station to create multiple simultaneous data streams.

1           3.     The method of claim 2, wherein the relay station is not directly  
2     connected to the base station but is connected to the base station through at least  
3     two different relay stations.

1           4.     The method of claim 2, further comprising communicating between  
2     the relay station and multiple base stations.

1           5.     The method of claim 4, further comprising dynamically reusing  
2     communication resources between the user equipment the multiple relay stations.

1           6.     The method of claim 1, wherein communicating between user  
2     equipment and the relay station comprises communicating a relay station specific  
3     pilot signal.

1           7.     The method of claim 1, wherein the second radio interface comprises  
2 multiple input multiple output transmissions.

1           8.     The method of claim 1, wherein the first radio interface and the  
2 second radio interface operate using a common frequency bandwidth.

1           9.     The method of claim 1, wherein the first radio interface comprise a  
2 macroscopic multiplexing where the relay station is connected to the base station  
3 directly and also via at least one other relay station.

1           10.    The method of claim 1, further comprising sharing resources between  
2 communication using the first radio interface and communication using the second  
3 radio interface, wherein the first radio interface and the second radio interface  
4 operate using different categories of communication links.

1           11.    The method of claim 10, wherein the different categories of  
2 communication links comprises multi-carrier modulation, spread-spectrum  
3 transmission, frequency division duplexing, and time division duplexing.

1           12.    A wireless communication system having a base station and a relay  
2 station that communicate with user equipment, the system comprising:  
3                a base station having a first radio transceiver and being connected to a  
4 core network;  
5                a relay station having a second radio transceiver and being configured  
6 to communicate with the base station using a first radio interface; and  
7                user equipment having a third radio transceiver and being configured  
8 to communicate with the relay station using a second radio interface, wherein the  
9 operation of the first radio interface and the second radio interface are separate  
10 from each other.

1           13. The system of claim 12, wherein the operation of the first radio  
2 interface and the second radio interface includes, at least in part, using the same  
3 frequency bandwidth.

1           14. The system of claim 12, further comprising at least one other relay  
2 station being configured to communicate with the relay station and the base  
3 station.

1           15. The system of claim 14, wherein the relay station communicates with  
2 the base station directly and simultaneously via the at least one other relay station.

1           16. The system of claim 15, wherein the relay station is not directly  
2 connected to the base station but is connected to the base station through at least  
3 one different relay station.

1           17. A device configured for operation in a wireless multi-hop  
2 communication environment, the device comprising:

3                 a radio interface that communicates with relay stations in a multi-hop  
4 communication environment; and

5                 a processor coupled to the radio interface, the processor providing  
6 commands for multiple input, multiple output communication via the radio interface  
7 when high data rates are needed.

1           18. The device of claim 17, wherein the radio interface comprises multiple  
2 antennas.

1           19. The device of claim 17, wherein the radio interface communicates a  
2 relay station specific pilot signal.

1           20. The device of claim 17, further comprising a memory apparatus  
2 containing identification information.

1           21.   The device of claim 17, wherein the radio interface communicates  
2   using time division multiple access.

1           22.   A device configured for operation in a wireless multi-hop  
2   communication network, the device comprising:

3                   a radio interface that communicates with user equipment and other  
4   network devices in a multi-hop communication network; and

5                   a processor coupled to the radio interface, the processor providing  
6   commands for multiple input, multiple output communication via the radio interface  
7   when high data rates are needed.

1           23.   The device of claim 22, wherein the radio interface comprises multiple  
2   antennas.

          24.   The device of claim 22, wherein the radio interface receives a  
          relay station specific pilot signal and compares the relay station specific pilot  
          signal with an identification signal.